

REMARKS

Claims 1-23 are pending in the present application. Claims 21-23 are withdrawn from consideration. Claims 1-20 stand rejected. By this amendment, claim 5 is amended to correct a typographical error. This application continues to include claims 1-23.

Claims 1-20 were rejected under 35 USC 102(b) as being anticipated by Sakuma (U.S. Patent No. 5,663,750). Reconsideration of the rejection of claims 1-20 is respectfully requested in view of the following.

Sakuma discloses an ink ejection system, wherein to properly continue printing when an amount of ink remaining in the ink reservoir is small, an amount of ink remaining in the ink reservoir is detected. When the detection results indicate that less than a predetermined amount of ink remains in the ink reservoir, then printing is performed using less ink than is used during normal printing.

As shown in embodiments depicted by flowcharts of Sakuma Figs. 4-10, it is to be noted that the process returns to the point "circle 1", only after the ink cartridge has been exchanged. In each of the embodiments of Sakuma, the determination of "little ink left" occurs only once per ink cartridge, and ink reduction occurs only once, as more fully described below. Thus, Sakuma does not disclose, teach or suggest "progressively reducing an image density" of an image formed by the imaging apparatus, let alone progressively reducing an image density of an image based on a print mode the imaging apparatus, e.g., ink jet printer, was operating in when said notice threshold was reached, as variously recited in Applicants' independent claims 1, 10 and 19.

In the embodiment of Fig. 4, after the determination of "little ink left" at step S1, the drive signal is changed (only once) at step S4, and the process remains in the loop of steps S5 and S6 until the ink cartridge is exchanged.

In the embodiment of Sakuma Fig. 5, which is a variant of Fig. 4, after the determination of “little ink left” at step S1, at step S11 a determination is made as to whether a page change has occurred. If NO, then the process remains in the loop of steps S11-S13 until the ink cartridge is exchanged, with no reduction in ink consumption. If YES, then, as in the embodiment of Fig. 4, the drive signal is changed (only once) at step S4, and the process remains in the loop of steps S5 and S6 until the ink cartridge is exchanged.

In the embodiment of Sakuma Fig. 6, which is a variant of Fig. 5, after the determination of “little ink left” at step S1, “[I]n the second modification, in S11 of Fig. 6, whether or not a subsequent print start command has been received is determined rather than whether or not a change-of-page signal has been received. In this way, each series of printing operations will be continued without changes in the tone of printed images. The next series of printing operations will be continued using lower volume ink droplets.” (Sakuma, column 6, lines 59-65). In other words, if the determination of whether the operation is the normal print mode at step S14 is YES, then as shown in Fig. 7 the process remains in the loop of steps S16 and S17 until the ink cartridge is exchanged, with no reduction of ink consumption. If the determination of whether the operation is the normal print mode in step S14 is NO, then at step S15 the drive voltage is reduced (only once) and the process remains in the loop of steps S16 and S17 until the ink cartridge is exchanged.

In the embodiment of Sakuma Fig. 7, after the determination of “little ink left” at step S1, if determination of whether the operation is the normal print mode at step S14 is YES, then as shown in Fig. 7 the process remains in the loop of steps S16 and S17 until the ink cartridge is exchanged, with no reduction of ink consumption. If the determination of whether the operation is the normal print mode at step S14 is NO, then at step S15 the

drive voltage is reduced (only once) and the process remains in the loop of steps S16 and S17 until the ink cartridge is exchanged.

In the embodiment of Sakuma Fig. 8, and as described in Sakuma, column 7, line 40-column 8, line 25, on which the Examiner heavily relies, reduction in ink consumption is reduced by a single fixed amount, depending on the mode of operation at the time that the detection of only a little of ink remaining occurs. Referring to step S14, a determination is made as to whether the operation is a normal print mode. As stated in Sakuma at column 8, lines 7-13, when little ink is found to remain (step 1) while printing is being performed using the normal printing mode (YES at step S14), the volume of ejected droplets is reduce to $2/3$ by changing the mode to the ink saving mode, and the process remains in the loop of steps S16 and S17 until the ink cartridge is exchanged. When little ink is found to remain (step S1) while printing is being performed using the ink saving mode (NO at step S14), the volume of ejected droplets is reduced to $1/2$ by reducing the drive voltage (only once) and the process remains in the loop of steps S16 and S17 until the ink cartridge is exchanged. Thus, a single reduction in ink volume occurs, depending on the mode of operation at the time of the detection of only a little of ink remaining occurs.

In the embodiment of Sakuma Fig. 9, if at step S33 it is determined that the amount of ink to be consumed (A) is greater than the amount of ink remaining (B), and that the amount of ink remaining (B) is greater than one-half the amount of ink to be consumed (A), then at step S35 the drive voltage is lowered (temporarily), and then increased back to the original drive voltage at step S37 after printing at step S36. Again, there is only a single reduction in ink consumption.

In the embodiment of Sakuma Fig. 10, after the determination of “little ink left” at step S51; at step S55 only if the amount of ink to be consumed (A) is greater than the predetermined amount is the drive voltage lowered (only once) at step S57, and the process remains in the loop of steps S58 and S59 until the ink cartridge is exchanged. If the determination at step S55 is NO, printing occurs with no change in ink consumption amount and the process ends.

Thus, in each of the Sakuma embodiments, the determination of “little ink left” occurs only once per ink cartridge, and ink consumption reduction occurs only once. In contrast, each of Applicants’ independent claims 1, 10 and 19 variously recite “progressively reducing an image density of an image” formed by the imaging apparatus, e.g., ink jet printer, based on a print mode the imaging apparatus (e.g., ink jet printer) was operating in when said notice threshold was reached.” (Emphasis added). This “progressive” reduction of the image density is successive multiple reductions in image density.

For example, and without intent to limit the scope of Applicants’ claims to this example, as set forth in Applicants’ specification at page 8, line 19–page 9, line 2, and with reference to Applicants’ Fig. 4, “in this embodiment, each print mode has associated therewith a predefined number of print swaths that will be counted before the next print fade bit is set. Control module 18 is programmed to count the number of print swaths that are printed after notice threshold 70 has been reached. The swath count is communicated to controller 56 in order to appropriately set a particular print fade level bit in print fade array 68 of memory 58, and in turn, to select the appropriate print density associated with the particular print fade level bit. In the embodiment shown in Fig. 3, for example, in order to reduce the print density of printhead 36, individual ones of the primary address lines A1-An and/or secondary address lines C1-Cn are masked so as to mask out a corresponding portion of the ink jetting actuators 52. With each addition print fade level bit set in print fade array 68 of memory 58, the

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number of address lines masked increases, and in turn the number of ink jetting actuators masked increases, so as to progressively reduce the print density of images formed by imaging apparatus 12 based on the print mode that imaging apparatus 12 was operating in when the event occurred, i.e., when notice threshold 70 was reached. ” (Emphasis added).

As further stated, for example, with respect to Applicants’ Fig. 5, at page 9, lines 29-31, “At step S104, a respective number of print swaths is defined for each of the plurality of print modes at which a next print density of the plurality of print densities defined in step S102 will be selected.” As further stated, for example, with respect to Fig. 5 at page 11, lines 14-18, “At step S108, upon reaching the notice threshold, an image density of an image formed by printhead 36 on print medium 28 begins to be progressively reduced based on a print mode that imaging apparatus 12 was operating in when notice threshold 70 was reached. The progressive reduction of the image density is due to the incremental selection of a print density from the available print densities.”

Thus, Sakuma, does not disclose, teach or suggest “progressively reducing an image density of an image formed by said imaging apparatus based on a print mode said imaging apparatus was operating in when said notice threshold was reached,” as recited in each of Applicants’ independent claims 1 and 10, nor does Sakuma disclose, teach or suggest “progressively reducing an image density of an image formed by said ink jet printer based on a print mode said imaging apparatus was operating in when said notice threshold was reached.”

Accordingly, independent claims 1, 10 and 19 are allowable in their present form.

Claims 2-9 depend, directly or indirectly, from claim 1; claims 11-18 depend, directly or indirectly, from claim 10; and claim 20 depends from claim 19. Accordingly, claims 2-9, 11-18 and 20 are believed allowable due to their respective dependence from an otherwise allowable base claim.

In addition, claims 2-9, 11-18, and 20 are patentable in their own right.

For example, with respect to claims 2, 6, 11, 15 and 20, Sakuma does not disclose, teach or suggest defining a respective number of print swaths for each of the plurality of print modes at which a next print density of a plurality of print densities will be selected to facilitate the progressively reducing step. In rejecting claims 2, 6, 11, 15 and 20, the Examiner relies on Sakuma column 8, lines 7-13. However, the cited passage discloses an amount of a single reduction, depending on which of the two print modes the system is operating. There is no disclosure, teaching, or suggestion in Sakuma of any progressive reduction, and there also is no disclosure, teaching, or suggestion of defining a respective number of print swaths for each of said plurality of print modes at which a next print density of a plurality of print densities will be selected to facilitate said progressively reducing step. Accordingly, claims 2, 6, 11, 15 and 20 are believed patentable in their own right.

In rejecting claims 4 and 13, the Examiner relies on Sakuma column 2, lines 5-12 and column 8, lines 15-25, for disclosing “said notice threshold is one of a plurality of thresholds, each of said plurality of thresholds having associated therewith a respective corresponding amount of ink remaining.” Sakuma column 2, lines 5-12 discusses a single threshold, and column 8, lines 15-25 describes alternative ways to reduce image density, without any reference to a threshold. Nowhere in the cited passages is there any disclosure, teaching or suggestion of multiple thresholds. In each of the Sakuma embodiments, depicted in Figs. 4-10, there is only one threshold, and that is whether there is “a little ink left”. Accordingly, claims 4 and 13 are believed patentable in their own right.

In rejecting claims 5 and 14, the Examiner relies on Sakuma column 8, lines 7-13, for disclosing, “defining a plurality of print densities for use in progressively reducing said image density of said image” (claim 5) and “selecting a print density from a plurality of print

densities for use in progressively reducing said image density of said image” (claim 14). However, the print densities of Sakuma in the cited passage are not used in “progressively reducing said image density” [based on a print mode the imaging apparatus, e.g., ink jet printer, was operating in when the notice threshold was reached, as recited in the respective base claim]. Rather, in the relied on passage from Sakuma, one density is used if the threshold is reached when operating in the normal mode, and another print density is used if the threshold is reached when operating in the draft mode. Accordingly, claims 5 and 14 are believed patentable in their own right.

Claims 7, 8, 16 and 17 are believed patentable in their own right for substantially the same reasons set forth above with respect to claims 6 and 15, respectively.

Claims 9 and 18 are directed to, wherein the step of progressively reducing an image density is achieved relatively uniformly for each of a first print mode and a second print mode. For reasons set forth above, Sakuma does not disclose, teach or suggest progressively reducing an image density, and accordingly, cannot disclose, teach or suggest uniformly progressively reducing an image density for each of a first print mode and a second print mode. Accordingly, claims 9 and 18 are believed patentable in their own right.

For the foregoing reasons, Applicants submit that the pending claims are in condition for allowance, and Applicants respectfully request withdrawal of all rejections and allowance of the claims.

In the event Applicants have overlooked the need for an extension of time, an additional extension of time, payment of fee, or additional payment of fee, Applicants hereby conditionally petition therefor and authorize that any charges be made to Deposit Account No. 20-0095, TAYLOR & AUST, P.C.

Should any question concerning any of the foregoing arise, the Examiner is invited to telephone the undersigned at (317) 894-0801.

Respectfully submitted,



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